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Editorial – Issue 1

Industrial Policy: New Technologies and Transformative Innovation Policies?

David Bailey, Amy Glasmeier, Philip R Tomlinson and Peter Tyler

Industrial Policy and Industrial Strategy

Deep History

In many parts of the world, stagnant economies, rising inequality, and sluggish regional growth have renewed interest in and experimentation with industrial policy. This reflects a longstanding trend in economic history, where economic downturns have invariably led to follow-on attempts of some form of state-led economic revival and subsequent policy cycles, usually accompanied with regime change to contain some type of shock (Williams, 2012). Examples abound. In the late 18th century, in the United States, the first evidence of industrial policy – largely through the efforts of Alexander Hamilton (the First US Treasury secretary) and his 1791 *Report on the Subject of Manufactures* - accompanied the nation's hard-fought economic independence which energized the nation's elite to emulate features of European industrialization in pursuit of modernization; policy instruments included closed borders and import substitution frequently aided by piracy and industrial espionage (see Irwin, 2004). These ideas were strongly supported by the German-American economist, Frederick List (1841), who provided one of the first theoretical treatises for industrial policy by arguing that policymakers should take a long term view of economic development and intervene accordingly, especially to promote domestic manufacture and commerce (see Chang, 2002).

Skipping forward to the 1940s, UK industrial nationalisation was thought to be an antidote to industrial collapse following World War II (Williams, 2012). Not long after (during the 1950s), the Italian government utilized massive infrastructure investments in the hope of generating external economies and industrialization to absorb a burgeoning population that had outgrown the region's backward agrarian sector (Alacevich 2013). The intent was to wrest the South from its long term malaise, leaving to private interests the selection of industries to promote (Chenery 1962). Shortly thereafter, the US. buried by massive economies of scale that accompanied industrial production in support of the World War II build-up was subsequently unburdened by this surplus, aided by the stimulus accompanying post-War reconstruction, which ultimately enabled U.S. domination of international markets. International demand soaked up excess capacity and alleviated possible gluts of basic commodities in everything from steel to textiles. In that instance, industrial policy was a by-product of both trade policy and security policy (Glasmeier et.al., 1993). The freshly emboldened American industrial system, bloated by military-related

goods and services, sparked another round of investment, this time aimed at the electronics age. Two decades later, the neo-mercantilist growth policies of the countries of Japan, South Korea, and later China unleashed another round of industrial policy and the resulting protectionist action toward rising imports of not just more, but higher quality and more valuable goods (see Khan, 2015). Trade policy has always been used to protect industries at risk, often despite the lack of fundamental competitiveness of the industry in question (Schoch 2001).

Today's embrace of industrial policy represents a deep-seated dissatisfaction with the prevailing open-market model that enabled countries like China to garner 25 percent of the world's market for manufactured goods. Once again, policies emerge when deals around the table are perceived as increasingly unfair and on the receiving end uneconomic. Regardless of era, national industrial policy is called upon to counter the effect of uneven economic growth. Industrial policy is almost never the sole focus of a particular technology's, service, or troubled resource circumstance. Instead, in economic history, industrial policy has almost always done double duty either to manage the effects of macroeconomic flux or to achieve some other political objective.

The Current Period

After the Great Recession, actions on the part of advanced industrial countries such as Germany once again led to a re-assessment of the role of the state in market economies (Chang et. al, 2013). This time, government involvement in the economy appears to be more favourably viewed in the light of an undeniable pattern of uneven development left over from the economic turmoil unleashed at the turn of the new century. Industrial policy itself has sometimes been seen as a euphemism for a range of policies aimed at enhancing (or safeguarding) a country's economic base. Rationales for policy measures include (but are not limited to) support of 'infant industry', science, technology and innovation (STI) policies, human capital development, state procurement, regulation (and deregulation) and anti-trust policy, merger policy, policies in relation to foreign direct investment, intellectual property rights, the allocation of financial resources, and the development of regional clusters among others (Cimoli et.al, 2009).

By and large, such measures are implemented on an ad-hoc basis, taking the form of either 'vertical' or 'selective' interventions to support specific manufacturing firms and sectors (Warwick, 2013). Depending on the era, industrial policy gestures are chastised for 'picking winners;' central governments are criticized for either promoting 'national champions' or providing supports for 'lame duck' firms to safeguard employment in regional industries in a state of long term decline. In the UK, during the 1970s, such support extended to notable failing companies such as British Aerospace and the Rolls Royce Corporation (ironically, both now are successful UK companies) through either partial or full nationalization (Coates, 2015). As the general economic malaise of the late 1970s took hold, this approach was vociferously ridiculed and quickly became both politically and economically nonviable. Some evidence suggests these gestures were partial precipitants of the neo-liberal revolution.

Subsequently, insofar as the state played a role, actions were discreet and seen as ‘horizontal’ measures to facilitate a nurturing business environment ‘*by setting the rules of the game, ensuring the rule of law, and generally creating a market free of preferential subsidies to allow firms to compete on an equal basis*’ (Bartlett 2014, p. 5). Such measures notably included generic support for education and skills, infrastructure and the use of tax incentives to promote entrepreneurship, investment and Research and Development (R&D) (see Warwick 2013).

Today, modern industrial policies are frequently referred to as Industrial Strategy. As such, they are a means, but not an end unto themselves. These practices are construed instead as tactical gestures that encompass a ‘*set of measures taken by the state to influence/enhance the performance of firms, sectors, industries, and clusters towards a desired objective (such as inclusive growth)....*’ and which also recognise (and support) ‘*sectoral interdependencies between manufacturing and services, and even agriculture*’ (Pitelis, 2015, p 18). As such, industrial policy is no longer about ‘picking winners’ but in addressing systemic and market failures; the task then is to create an environment (or stable/seedbed) out of which ‘winners’ may arise (Bailey and Tomlinson, 2017). Based on his view, Aiginger (2007; 297) characterizes ‘systemic industrial policy’ as that which ‘*goes beyond combating market failures. It acknowledges limited knowledge of policymakers, mutual learning, and co-operation between firms, institutions, and government*’. In this sense, commonly adopted definitions of industrial strategy are now intentionally narrow, seeking to call out where practical that ‘good practice’ industrial strategy is much more ‘holistic’ in approach, attending to both demand and supply considerations while encouraging industrial development. According to Dani Rodrick, contemporary examples of the industrial strategy focuses on the discovery process, whereby firms and the state learn about underlying costs and opportunities and engage in strategic coordination (see also Bailey and De Propriis, 2014).

New Technologies and Transformative Innovation Policy

Especially in the context of innovation policy, the advent of new technologies became a particular focus of Post War industrial policy. Two related developments encourage the latest round of technology-rich industrial innovation. First, policy-makers increasingly foster initiatives to enhance technologies positively. Innovative activities are expected to generate new ‘value’ a key stimulant of increasing productivity and economic growth. As such, public investment in science and technology is generally politically considered palatable. Harkening back to the recognized importance of specificity and distinction, countries are seen to embody historically specific and differential advantages: the military might of the U.S. unleashes a plethora of innovations related to discoveries made during the Second World War.

A new model of industrial prowess emerges that is centred on the nexus of science and technologies embedded in a matrix of industry, government and higher education. Japan's post-war reconstruction included the formation of strong central government institutions, like the Ministry of International Trade and Industry that directed national industrial policy for decades (see Johnson, 1975). Furthermore, a new model is made essential since private investment in

Research and Development (R&D) can be sub-optimal given that at a point in time, firms may lack the ability to appropriate the full return of their investment due to the public goods nature of (new) knowledge (Stoneman and Vickers, 1988). Also, uncertainty and asymmetric information can hinder markets in nurturing effective collaboration between firms, universities, and state agencies to enhance innovation.

Similarly, a lack of knowledge about new technologies (and their applications) can stifle market demand and technological diffusion. In each case, the state – through its various agencies - can facilitate new network connections (Block, 2011) while also validating and demonstrating new technologies to raise confidence and enhance adoption (Hauser, 2014). Beyond the private/social wedge, the state – often through international state collaboration - also plays a critical role in addressing risky and long term societal missions such as space exploration and tackling climate change (Mazzucato, 2013).

Present Day

The revived interest in industrial policy comes at a time of a new technological transformation, and the arrival of radical and disruptive technologies associated with the applications of artificial intelligence, automation and machine learning. Industry 4.0 (I4.0) and the so-called Fourth Industrial Revolution embody technologies such as advanced robotics, increased automation, digitalization and data exchange in manufacturing technologies supported by artificial intelligence, cyber-physical systems, platform economy innovations, and cloud computing. Further development of these technologies can unleash a significant disruptive process, requiring changes in the organization of production from within and outside the workplace, among firms, and across the manufacturing and services sectors. These new technologies rely on platforms that utilize big data analytics to identify and enable new business opportunities and facilitate more significant interaction between producers and consumers in the process of customizing products (Bailey and De Propriis, 2019). The increasing advance of such technologies poses real challenges for industrial policy and wider socio-economic cohesion. With new capital intensive technologies capable of displacing labour, much speculation exists as to whether beneficiaries will reside in more dynamic regions exacerbating and extenuating further socioeconomic and regional divides.

At the European level, addressing these challenges is embodied within the European Union's Research and Innovation Strategies for Smart Specialisation (RIS3) programme. Smart specialization strategies (S3) have become the main component of the EU's 2014-2020 'Innovation Union' being described as the world's biggest and boldest industrial policy experiment ever undertaken (Radošević et al. 2017; see Marques and Morgan, 2019, this issue). The concept itself emerged from the Knowledge for Growth (K4G) network (2005–2009), a group of innovation scholars - commissioned by EU Commissioner Janez Potočnik - to explore ways in which policy can raise European knowledge creation/transfer and enhance innovation-led growth.

The basic premise of S3 revolves around public-private partnerships in which state funds are prioritized and allocated to specific 'activities' in particular technological fields in uncharted

technologies, and fields or domains which have the potential for ‘entrepreneurial discovery’, knowledge spill-overs, innovation, scale, agglomeration and commercial exploitation (Foray, 2015). Hence, S3 is a return to a more vertical and selective mode of policy intervention. The emphasis upon ‘entrepreneurial discovery’ reflects Rodrik’s (2004) view that private actors are best placed in the market to identify new opportunities for commercial exploitation. These opportunities may arise at the interstices of sectors, for example in material science where a range of materials (such as ceramics, metals, and polymers) are now being used as part of a range of applications resulting in new products and industrial efficiency. Hence the focus is upon ‘activities’ and experimentation rather than supporting specific sectors, per se.

Upon conception, the S3 concept came under harsh criticism due to its undeniable spatial effect and given its close alignment with regional specializations within industrial clusters. In particular, the ‘entrepreneurial discovery process’ cast as a ‘bottom-up process’ involving local stakeholders sharing information, deliberating and identifying new opportunities, was seen to build upon a region’s existing and historical advantages and capabilities. As such, S3 has become synonymous with place-based approaches to industrial policy (McCann & Ortega-Argiles, 2015). The potential of S3 is said to lie in transforming regional economies by enabling them to develop new specialisms that enable movement onto new trajectories. In reality, initial endowments are seen as critical determinants of an area’s prospective benefit from S3; lagging regions, in particular, are likely to be at a distinct disadvantage (see Barzotto et al., 2019, this issue).

The notion of ‘smart’ itself is seen as problematic. In recent years, it has become a ubiquitous term or ‘buzzword’ that has entered the policy lexicon; ‘smart states,’ ‘smart’ manufacturing, ‘smart’ cities, ‘smart’ workers and ‘smart’ highways. The danger is, as a binary, there necessarily must be winners and losers. Smart Specialisation is no exception in this regard, and it may be preferable that innovation policy is (and needs to be) more nuanced.

This Special Issue

This is the first of two issues exploring the potential of industrial policy to act as a catalyst in reviving economies and enhancing growth in a sustained way. This first issue focuses specifically upon a particular facet of the industrial system that is the challenges posed by the advent of new technologies and the role of policy in enhancing innovation and transforming trajectories at regional, national and international levels. The second issue, in November 2019, focuses more on the place-based elements – beyond smart specialisation - of industrial policy.

The collection of papers begins with a thought-provoking article by Marques and Morgan who reconsider the role of the state in innovation policy through the lens of New Industrial Policy (NIP). As the authors discuss, the advent of New Industrial policy has presented an opportunity for much debate about the state in economic development (Rodrik (2016), Sabel (Sabel and Zeitlin, 2012) and Mazzucato (2013b), challenging the conventional neo-liberal critique of state intervention. However, the authors question the way in which the NIP narrative is evolving into regional policy with a prominent example being the roll-out of the Smart Specialization Strategy (S3) across EU

regions. Two specific concerns stand out. The first is the lack of understanding as to how NIP engages with the fundamental paradox that those regions with the greatest need for innovation support are the ones that have the lowest institutional and thus governance capacity to benefit from the policy instruments available to them. As they argue; *‘without a stronger emphasis on place-based policies, and without the resources to ensure effective implementation of such policies, NIP in Europe may have unintended consequences which limit the impact of such policies.’* The second is to recognize that NIP, represented in S3, is a multi-scalar policy. As such it has the potential to enhance the quality of the governance process at even the most local level of decision-making, and it should seek to do so where this is possible.

The second article by Janssen and Frenken addresses the concept of ‘cross-specialization’ industrial policy and thus the rationale and options for linking unrelated industries. A central theme of their research is the opportunity to improve industrial competitiveness by linking strong, but separate knowledge bases. Their view is that there is scope to encourage opportunities for cross-specialization that initiate knowledge flows that can enable economic diversification. When considering the relevant interfaces, they suggest that it is important to align the type of intervention based upon its technological or thematic content. A key objective of ‘cross-specialization policy’ is to enable knowledge basis to converge. As the authors admit, cross-specialization policy should be seen as a generic principle and not necessarily constrained to any particular geography. However, they can see reasons why it might work best at a lower level of geographical resolution because it is precisely at this level that geographical proximity can provide opportunities for the ‘thick interactions’ required to ‘bridge cognitive distances.’ However, in practice, a cross-specialization policy is likely to be less successful in lagging regions because they are often highly specialized with fewer options for cross-specialization.

In the third article, Barzotto, Corradini, Fai, Labory and Tomlinson recognize the role of S3 in building a region’s existing advantages and capabilities in stimulating opportunities for knowledge transfer and innovation opportunities. However, they recognize the paradox highlighted by Morgan and Marques that the less developed regions lack the networks and capabilities to gain the most benefit. They consider how S3 might seek to help less developed areas and in particular the arguments for encouraging technological diversification and upgrading by developing extra-regional collaborative linkages. Their research suggests that extra-regional collaboration does have the opportunity to work in this way but that cross-regional collaborative relationships based on technological similarity may be more successful in leading regions. An implication of their analysis is that ‘place-based’ innovation and industrial policies are essential; regions are highly heterogeneous, and policy actions have to be tailored to regional specificities’ with lagging regions often lacking the technological capabilities and networks to participate fully and benefit from initiatives like S3.

In the fourth article, Bianchi and Labory argue that converging technological innovations are provoking significant structural changes within industries. Clearly, industries are not isolated from the economy of which they are apart. If industrial policy is to have desired impacts, then the

formulation of policy has to comprehend this complexity. As the authors argue, even in a world of global value chains (GVCs), regions are vital as they provide the appropriate capabilities and resources: infrastructure, and institutions that enable businesses to build their GVCs. Against this backdrop, the researchers believe that an Evolutionary Economic Geography (EEG) framework can provide a view of regions as complex adaptive systems, and industries as their subsystems. Such an approach can help integrate different elements of industrial policy (like innovation policy, competition policy, and infrastructure policy) that are typically addressed separately, can produce a combined impact over time. A unified theoretical framework would help with policy coherence. By focusing on the EEG approach in this way the authors can move thinking on EEG from its traditional focus on structure and more to the question of agency, and thus the collective actions of individuals and institutions. Smart Specialisation' Strategies are considered as industrial policy, based on the entrepreneurial discovery process.

The researchers draw empirically on the example of the industrial policy designed and implemented by the Emilia Romagna (ER) region in Italy drawing out four main elements of the regional industrial system that provide enabling conditions that influence the success of Industrial Policy. These are the development of capabilities (particularly R&D, skills and infrastructure), networking, policy coherence and encouraging participative governance structures. The article stresses that the involvement of regional stakeholders in the policy process is critical in accessing relevant information and knowledge to enhance decision-making, and mobilizing all parts of the local system towards the agreed and shared objectives.

While there has been much debate in Europe about the relative merits of different approaches to place-based industrial policy, less discussed but still evident is the role of such practices in U.S. regional development. While perhaps not as explicit as Europe, the USA exhibits several examples of place-based industrial policy (Appalachia and coal; oil and Texas and Louisiana; defence spending in the South and West; agriculture in the Midwest, especially the production of corn for ethanol). In the 1980s, it might have appeared to be an absence of a countrywide Federal approach to industrial policy, close examination of defence spending, agriculture, and energy policies, refute that assertion. Clark and Doussard argue in the fifth article that most recently there has been more apparent gestures toward industrial policy. The National Network of Manufacturing Institutes (NNMI) has provided a federal intervention which is more like traditional European industrial policy in that it invests in new technology through the operations of regional technology institutes (MIIs), linking technological development to industrial capacity and ultimately the creation of jobs. Clark and Doussard see MIIs as presenting a 'new frontier' in the development of federal influenced place based industrial policy in the USA since they '*connect technology to the manufacturing economy in highly uneven and differentiated ways, an outcome that underscores the need for place-based rather than place-agnostic industrial policies.*' The authors argue that the ability to adapt national industrial policy to regional conditions may help to overcome previous policy failures by providing a nationally networked group of locally sensitive institutions. However, the researchers emphasize that the initiative also reveals '*a more basic and stubborn set*

of challenges: the dominance of established interests in regional innovation systems and the persistent and unrelenting tendency of path dependencies to result in places left behind.'

In the sixth article, Pitelis, Vasilakos, Chalvatzis, and Pitelis, examine whether Industrial Policy (IP) can help to encourage innovation in Renewable Energy Technologies (RET) using data from across the OECD and the EU. Their focus is on understanding the effect of three broad categories of IP instruments; namely technology –push (R&D grants and loans, and tax incentives), demand-pull (feed-in tariffs and subsidies), and systemic (tax and subsidy reforms and the education system). The evidence indicates that Industrial Policy can have a positive and significant impact on RET. Relative success varies by country experience (thus capturing a 'learning experience'), the effect of regional variations (particularly a north/ south division in the context of the EU) and the relationship between Industrial policy and the quality of innovation produced. Demand-pull instruments are the most effective, especially in high intervention countries. Targeting RETs varies by national context, with the more policy-experienced countries showing the more effective outcomes. There were regional variations between the North and South of the European Union with the latter tending to be less effective in securing innovation.

In the seventh article, Michael Kitson argues that innovation policy is clearly of central importance in industrial policy but there is a tendency for policy to be too concentrated on the *generation* of innovation ('white coat syndrome') and not enough on *diffusing* what already exists in a way that recognises the structural specificity and specific needs of a local economy. Getting this right requires extensive knowledge exchange and boundary spanning skills. Moreover, the objective should be enhance performance in this respect across all sectors, including 'traditional sectors'. Strengthening connectivity with local 'anchors' like universities and hospitals is also important and they have the advantage of being relatively fixed in the place and a source of resilience. Building such connectivity and collaboration requires the development of new local structures that can align the interests and coordinate the actions of the relevant actors with an emphasis on a sustainable, long-term impact.

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